

REMARKS

Response to Objections to Claims 94 and 97-98

In the January 31, 2006 Final Office Action, the Examiner objected to claims 94 and 97-98 for reciting the term "commensurate" and asserted that it is unclear to the Examiner what Applicants intended to include/exclude using such a term (see Office Action, page 2, lines 17-20).

Applicants respectfully traverse the Examiner's objection to the term "commensurate." The term "commensurate" has a clear and well-defined meaning in the field of material science. Specifically, this term refers to the pseudomorphic growth of an epitaxial layer over a substrate that has a slightly different lattice constant from the epitaxial layer. When the lattice mismatch between the epitaxial layer and the substrate is relatively small and when the thickness of the epitaxial layer is below a critical thickness, the atomic planes on the two sides of the epitaxial/substrate interface are aligned perfectly with each other, and the lattice mismatch is accommodated by an elastic strain in the epitaxial layer. Such a growth mode is typically referred to as pseudomorphic or commensurate growth. In contrast, when the epitaxial layer grows above the critical thickness, the elastic strain contained in the epitaxial layer will be released to generate a large density of misfit dislocation defects at the epitaxial/substrate interface, which is typically referred to as in-commensurate growth. See Chapter 4.2: Semiconductor-Semiconductor Heterojunctions, as downloaded from http://www.ifm.liu.se/courses/tfyy77/Course%20Note%20L4_Schottky%20contacts%20_.pdf on March 28, 2006; see also P.B. Hirsch, *Nucleation and Propagation of Misfit Dislocations in Strained Epitaxial Layer Systems*, as downloaded from http://www.tf.uni-kiel.de/matwis/amat/def_en/articles/

[sir_peter/annotated_sir_p.html](#) on March 28, 2006. Copies of both articles are enclosed herewith for the Examiner's reference.

Therefore, the term "commensurate" as recited by claims 94 and 97-98 clearly refers to the pseudomorphic growth of an epitaxial layer over a substrate layer that has a slightly different lattice constant from the epitaxial layer, as explained hereinabove.

§102 Rejections of Claims 89-98 and 124

In the outstanding Office Action, the Examiner finalized the previous rejection of claims 89-98 and 124 under 35 U.S.C. §102(b) as alleged anticipated by U.S. Patent No. 5,241,197 to Murakami et al. (hereinafter "Murakami"). Specifically, the Examiner asserted that various components disclosed by Murakami in different embodiments are interchangeable and therefore can be combined to yield Applicants' claimed invention, as recited by claims 89-98 and 124.

Although Applicants disagree with the Examiner's assertions, Applicants have hereby amended claim 89, from which claims 90-98 and 124 depend, to further distinguish over the structures disclosed by Murakami, so that the current proceeding can be expedited for earlier allowance of claims 89-98 and 124.

Specifically, claim 89 has been amended to positively recite a layered structure that comprises: (1) a single crystalline substrate, (2) a first layer of relaxed $\text{Si}_{1-x}\text{Ge}_x$ formed epitaxially on said substrate, wherein the Ge fraction x in said first layer ranges from about 0.5 to about 0.8, (3) a second layer of Ge formed epitaxially on said first layer, wherein said second layer is under compressive strain and "has a thickness ranging from about 10 nm to about 15 nm," (4) a third layer of "undoped SiGe or Si formed epitaxially on said second layer, wherein

said third layer has a thickness of less than about 1 nm," and (5) a fourth layer of gate dielectric formed on said third layer.

Support for the second layer of Ge with a thickness from about 10 nm to about 15 nm can be found in the instant specification as originally filed on page 22, line 8. Support for the third layer of undoped SiGe or Si can be found in the originally filed claim 89 (which recites a third layer of undoped SiGe) and claim 97 (which recites substitution of the third layer of SiGe by a Si layer). Support for the third layer thickness of less than 1 nm can be found in the originally filed specification on page 28, lines 12-14.

It is therefore clear that the layered structure, as recited by claims 89-98 and 124 of the present invention, contains a significantly thicker second layer of Ge having a thickness from about 10 nm to about 15 nm, which functions as a carrier channel, and a significantly thinner third layer of undoped SiGe or Si having a thickness of less than about 1 nm, which functions as a cap layer. Specifically, the thinner third layer of undoped SiGe or Si is located above the Ge channel, but it does not act as a parasitic channel for carriers, such as electrons and holes (see instant specification, page 28, lines 12-14).

In the present Office Action, the Examiner referred to layer 55 in Figure 5 of Murakami as the third layer of undoped SiGe (see Office Action, page 3, lines 18-19). However, Murakami discloses that layer 55 has a thickness of about 100 Å, which is equal to 10 nm (see Murakami, column 5, lines 9-10).

Further, Murakami discloses a Ge channel layer 2 having a thickness of about 100 Å, which is approximately the same as that of the adjacent undoped SiGe layer 55 (see Murakami, Figure 5, and column 5, lines 8-9). Murakami specifically teaches that layer 55 is a part of the channel region (which includes layers 53, 2, 55, and 32) for carrier transportation, and it also

suggests that such a channel region can be replaced by a superlattice structure where the intrinsic germanium layer and the intrinsic undoped SiGe layer are alternately and repeatedly piled (see Murakami, column 5, lines 31-35).

Murakami therefore clearly teaches an undoped SiGe layer that has substantially the same thickness as the adjacent Ge layer, either in a bulk structure or in a superlattice structure.

The teachings by Murakami not only fail to provide any derivative basis for, but in fact lead away from, formation of a significantly thicker second layer of Ge having a thickness from about 10 nm to about 15 nm and a significantly thinner third layer of undoped SiGe or Si having a thickness of less than about 1 nm, as positively recited by claims 89-98 and 124 of the present application.

Therefore, Applicant's claimed invention, as recited by claims 89-98 and 124, patentably distinguishes over the Murakami reference.

Based on the foregoing, Applicants correspondingly request the Examiner to reconsider, and upon reconsideration to withdraw, the rejections of claims 89-98 and 124.

If any issues remain outstanding, incident to the formal allowance of the application, the Examiner is requested to contact the undersigned attorney at (516) 742-4343 to discuss same, in order that this application may be allowed and passed to issue at an early date.

Respectfully submitted,



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